What is claimed is:

1. A method comprising steps of:

receiving at least two space-time coded signals from an antenna system associated with a first station;

determining complex channel state information based on the received space-time coded signals; and

sending the complex channel state information to the first station.

2. The method of claim 1, further comprising a step of segmenting the complex channel state information into a plurality of channel state information segments, wherein the step of sending the complex channel state information includes sending the plurality of channel state information segments in a sequence.

3. The method of claim 2, wherein the step of segmenting the channel state information includes:

determining a number of phase bits allocated for phase information according to a mode of operation;

rounding and truncating a correction phase angle to fit into the number of phase bits;

determining a number of amplitude bits allocated for amplitude information according to the mode of operation; and

rounding and truncating a correction amplitude according to the number of amplitude bits.

4. The method of claim 2, wherein the step of sending the plurality of channel state information segments includes sending a correction phase angle most significant bit before sending a correction amplitude most significant bit.

5. The method of claim 2, wherein the step of sending the plurality of channel state information segments includes sending a correction phase angle most significant bit before sending a correction phase angle least significant bit.

6. The method of claim 2, further comprising steps of:

receiving the plurality of channel state information segments;

reconstructing the complex channel state information from the received plurality of channel state information segments; and

weighting first and second feed signals to feed respective first and second antennas based on the reconstructed complex channel state information.

7. The method of claim 2, wherein the step of sending includes sequentially sending the plurality of channel state information segments over a time period based on a channel coherence time.

8. The method of claim 1, wherein:

the antenna system includes a multi-beam antenna array;

the step of receiving receives first and second space-time coded signals from respective first and second beams of the multi-beam antenna array; and

the step of determining determines the complex channel state information based on the received first and second space-time coded signals.

9. The method of claim 8, further comprising steps of:

determining by the first station an angular power spectrum of a signal from a second station, the angular power spectrum defining first and second peaks at respective first and second angular positions; and

transmitting the first and second space-time coded signals in the respective first and second beams so that the first and second beams are pointed toward the respective first and second angular positions.

10. The method of claim 1, wherein the antenna system includes a multi-beam antenna array, the method further including steps of:

transmitting the at least two space-time coded signals in respective beams of the multi-beam antenna array with a signature code encoded in each respective signal of the at least two space-time coded signals, the signature codes being substantially

orthogonal so that a second station can separate and measure a channel impulse response corresponding to each space-time coded signal;

measuring the channel impulse response for each space-time coded signal at the second station, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

sending an indicia of the selected set of least attenuated signals from the second station to the first station.

11. The method of claim 1, wherein:

the antenna system includes first and second diversity antennas, the first and second diversity antennas being one of first and second orthogonally polarized antennas and first and second antennas spatially separated by at least one wavelength;

the step of receiving receives first and second space-time coded signals from respective first and second diversity antennas; and

the step of determining determines the complex channel state information based on the received first and second space-time coded signals.

12. The method of claim 1, wherein the antenna system includes plural diversity antennas spatially separated from each other by at least one wavelength, the method further including steps of:

transmitting the at least two space-time coded signals in respective antennas of the plural diversity antennas with a signature code embedded in each respective space-time coded signal, the signature codes being substantially orthogonal so that a second station can separate and measure a channel impulse response corresponding to each space-time coded signal;

measuring the channel impulse response for each space-time coded signal at the second station, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

sending an indicia of the selected set of least attenuated signals from the second station to the first station.

13. The method of claim 1, wherein the antenna system includes first and second diversity antennas, the first diversity antenna being orthogonally polarized with respect to the second diversity antenna, the method further including steps of:

transmitting first and second space-time coded signals in respective first and second diversity antennas with first and second signature codes embedded in the respective first and second space-time coded signals, the first and second signature codes being substantially orthogonal so that a second station can separate and measure a channel impulse response corresponding to each of the first and second space-time coded signals;

measuring the channel impulse response for each of the first and second space time coded signals at the second station, the first and second space-time coded signals including a least attenuated signal and a most attenuated signal; and

sending an indicia of the least attenuated signal from the second station to the first station.

14. The method of claim 1, further comprising a step of transmitting the first and second space-time coded signals with first and second signature codes embedded in the respective first and second space-time coded signals, the first and second signature codes being substantially orthogonal so that a second station can separate a composite signal into the first and second space-time coded signals, wherein the step of receiving receives the first and second space-time coded signals as the composite signal at the second station.

15. The method of claim 1, wherein the complex channel state information includes at least one weight, each weight including amplitude and phase angle information.

16. The method of claim 1, wherein the step of determining complex channel state information includes determining a correction phase angle to adjust a first phase of a first space-time coded signal transmitted from a first antenna relative to a second phase

of a second space-time coded signal transmitted from a second antenna so that the first and second space-time coded signals constructively reinforce at a second station.

17. The method of claim 16, wherein the step of determining a correction phase angle includes:

measuring a first phase angle defined by the first phase;

measuring a second phase angle defined by the second phase; and

determining the correction phase angle defined to be a difference between the second phase angle and the first phase angle.

18. A method comprising steps of:

transmitting at least two space-time coded signals in respective beams of a multi-beam antenna array associated with a first station, the beams transmitting a signature code embedded in each respective space-time coded signal, the signature codes being orthogonal so that a second station can separate and measure a channel impulse response corresponding to each space-time coded signal;

measuring the channel impulse response for each space-time coded signal at the second station, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

sending an indicia of the selected set of least attenuated signals from the second station to the first station.

19. The method of claim 18, further including steps of:

selecting at least two beams for transmission from the first station based on the indicia received from the second station;

transmitting the at least two space-time coded signals in the selected at least two beams;

determining complex channel state information based on the received space-time coded signals; and

sending the complex channel state information to the first station.

20. A method comprising steps of:

selecting at least two beams of plural beams formed by a multi-beam antenna array associated with a first station for transmission of a corresponding at least two space-time coded signals produced by a space-time encoder;

determining a time delay associated with each of the at least two space-time coded signals as received in each respective beam; and

setting into a variable delay line the time delay corresponding to each beam, each variable delay line being coupled between the multi-beam antenna array and the space-time encoder.

21. The method of claim 20, further comprising a step of measuring a channel response based on an up link signal from a second station.

22. The method of claim 21, wherein:

the step of measuring includes receiving plural signal components of the up link signal in corresponding plural beams of the multi-beam antenna array;

the step of selecting includes selecting the at least two beams based on the received plural signal components; and

the step of determining includes determining delay spreads for each of the received plural signal components and assigning to each beam the determined delay spread as the time delay to be set into the respective variable delay line.

23. The method of claim 20, further comprising steps of:

encoding each signal of the at least two space-time coded signals with a signature code that is mutually orthogonal to each other signature code encoded in the at least two space-time coded signals so as to form a reference space-time coded signal and at least one remaining space-time coded signal, wherein the step of setting includes delaying each signal of the at least one remaining space-time coded signal in a respective variable delay line to form at least one delayed space-time coded signal; and

transmitting the reference space-time coded signal and the at least one delayed space-time coded signal in respective beams of the at least two beams.

24. The method of claim 23, further comprising steps of:

receiving the reference space-time coded signal and the at least one delayed space-time coded signal from the multi-beam antenna array;

determining complex channel state information based on the received reference space-time coded signal and the received at least one delayed space-time coded signal; and

sending the complex channel state information to the first station.

25. The method of claim 24, further comprising a step of segmenting the complex channel state information into a plurality of channel state information segments, wherein the step of sending the complex channel state information includes sending the plurality of channel state information segments in a sequence.

26. A system comprising a remote station, the remote station including:

a receiver to receive at least two space-time coded signals from an antenna system;

a processor to determine complex channel state information from the received space-time coded signals; and

a transmitter to send the complex channel state information to a base station.

27. The system of claim 26, wherein:

the processor includes a processor module to segment the complex channel state information into a plurality of channel state information segments; and

the transmitter includes circuitry to send the complex channel state information in a sequence of the channel state information segments.

28. The system of claim 27, wherein the processor module to segment the channel state information includes:

logic to determine a number of phase bits allocated for phase information according to a mode of operation;

logic to round and truncate a correction phase angle to fit into the number of phase bits;

logic to determine a number of amplitude bits allocated for amplitude information according to the mode of operation; and

logic to round and truncate a correction amplitude according to the number of amplitude bits.

29. The system of claim 27, wherein the circuitry to send of the transmitter sends a correction phase angle most significant bit before sending a correction amplitude most significant bit.

30. The system of claim 27, wherein the circuitry to send of the transmitter sends a correction phase angle most significant bit before sending a correction phase angle least significant bit.

31. The system of claim 27, further comprising the base station wherein:

the base station includes a receiver to receive the plurality of channel state information segments;

the base station further includes a processor to reconstruct the complex channel state information from the received plurality of channel state information segments; and

the processor of the base station includes circuitry to weight first and second feed signals to feed respective first and second antennas based on the reconstructed complex channel state information.

32. The system of claim 27, wherein the circuitry to send of the transmitter sequentially sends the plurality of channel state information segments over a time period based on a channel coherence time.

33. The system of claim 26, wherein:

the antenna system includes a multi-beam antenna array;

the receiver receives first and second space-time coded signals from respective first and second beams of the multi-beam antenna array; and

the processor determines the complex channel state information based on the received first and second space-time coded signals.

34. The system of claim 33, further comprising the base station wherein the base station includes:

the multi-beam antenna array;

circuitry to determine an angular power spectrum of a signal transmitted from the remote station, the angular power spectrum defining first and second peaks at respective first and second angular positions; and

circuitry to transmit the first and second space-time coded signals in the respective first and second beams of the multi-beam antenna array so that the first and second beams are pointed toward the respective first and second angular positions.

35. The system of claim 26, further comprising the base station wherein:

the base station includes the antenna system, the antenna system being a multi-beam antenna array;

the base station includes circuitry to transmit the at least two space-time coded signals in respective beams of the multi-beam antenna array with a signature code encoded in each respective signal of the at least two space-time coded signals, the signature codes being substantially orthogonal so that a remote station can separate and measure a channel impulse response corresponding to each space-time coded signal;

the remote station includes circuitry to measure the channel impulse response for each space-time coded signal at the remote station, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

the remote station transmitter sends an indicia of the selected set of least attenuated signals from the remote station to the base station.

36. The system of claim 26, further comprising the base station wherein:

the base station includes the antenna system, the antenna system including first and second diversity antennas, the first and second diversity antennas being one of first and second orthogonally polarized antennas and first and second antennas spatially separated by at least one wavelength;

the receiver receives first and second space-time coded signals from respective first and second diversity antennas; and

the processor determines the complex channel state information based on the received first and second space-time coded signals.

37. The system of claim 26, further comprising the base station wherein:

the base station includes the antenna system, the antenna system including plural diversity antennas spatially separated from each other by at least one wavelength;

the base station further includes circuitry to transmit the at least two space-time coded signals in respective antennas of the plural diversity antennas with a signature code embedded in each respective space-time coded signal, the signature codes being substantially orthogonal so that the remote station can separate and measure a channel impulse response corresponding to each space-time coded signal;

the remote station includes circuitry to measure the channel impulse response for each space-time coded signal at the remote station, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

the transmitter of the remote station includes circuitry to send an indicia of the selected set of least attenuated signals from the remote station to the base station.

38. The system of claim 26, further comprising the base station wherein:

the base station includes the antenna system, the antenna system including first and second diversity antennas, the first diversity antenna being orthogonally polarized with respect to the second diversity antenna;

the base station further includes circuitry to transmit first and second space-time coded signals in respective first and second diversity antennas with first and second signature codes embedded in the respective first and second space-time coded

signals, the first and second signature codes being substantially orthogonal so that the remote station can separate and measure a channel impulse response corresponding to each of the first and second space-time coded signals;

the remote station includes circuitry to measure the channel impulse response for each of the first and second space-time coded signals at the remote station, the first and second space-time coded signals including a least attenuated signal and a most attenuated signal; and

the transmitter of the remote station includes circuitry to send an indicia of the least attenuated signal from the remote station to the base station.

39. The system of claim 26, further comprising the base station wherein:

the base station includes the antenna system and a transmitter coupled to the antenna system, the transmitter of the base station transmitting the first and second space-time coded signals through the antenna system with first and second signature codes embedded in the respective first and second space-time coded signals, the first and second signature codes being substantially orthogonal so that the remote station can separate a composite signal into the first and second space-time coded signals; and

the receiver of the remote station includes circuitry to receive the first and second space-time coded signals as the composite signal.

40. The system of claim 26, wherein the complex channel state information includes at least one weight, each weight including phase angle information.

41. The system of claim 26, wherein:

the antenna system includes first and second antennas; and

the processor to determine complex channel state information includes circuitry to determine a correction phase angle to adjust a first phase of a first space-time coded signal transmitted from the first antenna relative to a second phase of a second space-time coded signal transmitted from the second antenna so that the first and second space-time coded signals constructively reinforce at the remote station.

42. The system of claim 41, wherein the circuitry to determine a correction phase angle includes:

logic to measure a first phase angle defined by the first phase;

logic to measure a second phase angle defined by the second phase; and

logic to determine the correction phase angle defined to be a difference between the second phase angle and the first phase angle.

43. A system comprising a base station and a remote station wherein:

the base station includes a multi-beam antenna array and a transmitter to transmit at least two space-time coded signals in respective beams of the multi-beam antenna array, the beams transmitting a signature code embedded in each respective space-time coded signal, the signature codes being substantially orthogonal so that the remote station can separate and measure a channel impulse response corresponding to each space-time coded signal;

the remote station includes a receiver and a processor to measure the channel impulse response for each space-time coded signal, the space-time coded signals including a selected set of least attenuated signals and a remaining set of most attenuated signals; and

the remote station further includes a transmitter to send an indicia of the selected set of least attenuated signals from the remote station to the base station.

44. The system of claim 43, wherein:

the base station includes a processor to select at least two beams for transmission from the base station based on the indicia received from the remote station;

the base station further includes circuitry to transmit the at least two space-time coded signals in the selected at least two beams;

the processor of the remote station includes circuitry to determine complex channel state information based on the received space-time coded signals; and

the transmitter of the remote station includes circuitry to send the complex channel state information to the base station.

45. A system comprising a base station, the base station including:

a multi-beam antenna array;

first circuitry to select at least two beams of plural beams formed by the multi-beam antenna array for transmission of a corresponding at least two space-time coded signals produced by a space-time encoder;

second circuitry to determine a time delay associated with each of the at least two space-time coded signals as received in each respective beam;

at least two variable delay lines, each variable delay line being coupled between the multi-beam antenna array and a space-time encoder; and

third circuitry to set the time delay corresponding to each beam of the at least two beams into a corresponding delay line of the at least two variable delay lines.

46. The system of claim 45, wherein the first circuitry includes logic to measure a channel response based on an up link signal from a remote station.

47. The system of claim 46, wherein:

the up link signal includes plural signal components, each signal component being a received signal component in a corresponding beam of the plural beams of the multi-beam antenna array;

the logic to measure the channel response includes logic to receive the plural signal components of the up link signal and logic to select the at least two beams based on the received plural signal components; and

the second circuitry includes logic to determine delay spreads for each of the received plural signal components and logic to assign to each beam the determined delay spread as the time delay to be set into the respective variable delay line.

48. The system of claim 45, wherein:

the base station further includes the space-time encoder;

the space-time encoder encodes each signal of the at least two space-time coded signals with a signature code that is mutually orthogonal to each other signature

code encoded in the at least two space-time coded signals so as to form a reference space-time coded signal and at least one remaining space-time coded signal; and

the at least one variable delay line delays each respective signal of the at least one remaining space-time coded signal in a respective variable delay line to form at least one delayed space-time coded signal, the base station transmitting the reference space-time coded signal and the at least one delayed space-time coded signal in respective beams of the at least two beams.

49. The system of claim 48, further comprising a remote station, the remote station including:

a receiver to receive the reference space-time coded signal and the at least one delayed space-time coded signal from the multi-beam antenna array;

a processor to determine complex channel state information based on the received reference space-time coded signal and the received at least one delayed space-time coded signal; and

a transmitter to send the complex channel state information to the base station.

50. The system of claim 49, wherein:

the processor includes a processor module to segment the complex channel state information into a plurality of channel state information segments; and

the transmitter includes circuitry to send the complex channel state information in a sequence of the channel state information segments.

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